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NOTES ON THE EFFECTS OF TRAILING-EDGE SHAPES OF LOW-DRAG AIRFOILS ON PROFILE DRAG AND THE TRIM AND BALANCE OF CONTROL SURFACES

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NOTES ON THE EFFECTS OF TRAILING-EDGE SHAPES OF LOW-DRAG AIRFOILS ON PROFILE DRAG AND THE TRIM AND BALANCE OF CONTROL SURFACES

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Questions have arisen concerning the value of adhering to the specified cusp trailing-edge shapes on low-drag airfoils as opposed to trailing edges with straight-line elements and the effect of other unsymmetrical trailing-edge shapes on the airfoil profile drag and the trim and balance of control surfaces.

Comparative drag tests of a 0.20c straight faired aileron and a 0.20c cusp-type aileron, which adhered to the specified wing contour, as shown in figure 1, were made on a low-drag airfoil model (approximately NACA 66,2-116) in the NACA low-turbulence tunnel. The model with the cusp-type aileron had the lower drag coefficient. The increment, Δc_{d_o}, was equal to 0.0006.

Drag, lift, and aileron hinge moments were measured on a 100-inch-chord model (approximately NACA 65,2-417) with various modifications to the trailing edge of the 0.20c Frise type aileron as shown in figures 2 and 3. The profile drags with the aileron neutral for the various modifications, with the drag of the original shape used as a reference, are as follows:

	Δc_{d_o}
Modification no. 1	0.0001
Modification no. 2	0.0003
Modification no. 3	0.0009
Modification no. 4	0.0005

The effects of the same modifications on the aileron effectiveness and hinge moments are given in figure 4. The coefficients in all cases are based on the actual chord of the model as tested with the various modifications.

From the lift curves in figure 4 it can be seen that modifications no. 1 and no. 3 show little change in the slope of their lift curves from that of the original shape. Modifications no. 2 and no. 4, however, due to the shortening of the aileron chord, show a decrease in the slope of their lift curves.

From the hinge-moment curves in figure 4 it can be seen that the hinge moments for up deflections in modifications no. 1, no. 2, and no. 4 are lower than the hinge moments of the original shape. This decrease in the slope of the hinge-moment curve is attributed to the partial relieving or unstalling of the flow near the trailing edge of the aileron. Modification no. 3 failed to show this decrease in the slope of the hinge-moment curve because stalling at the trailing edge was present throughout the angular range of the aileron due to the high camber at the trailing edge.

The purpose of these data is to show qualitatively the effects of comparatively small modifications to the trailing edge of an aileron. The data are not sufficiently complete for design purposes.

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L-450

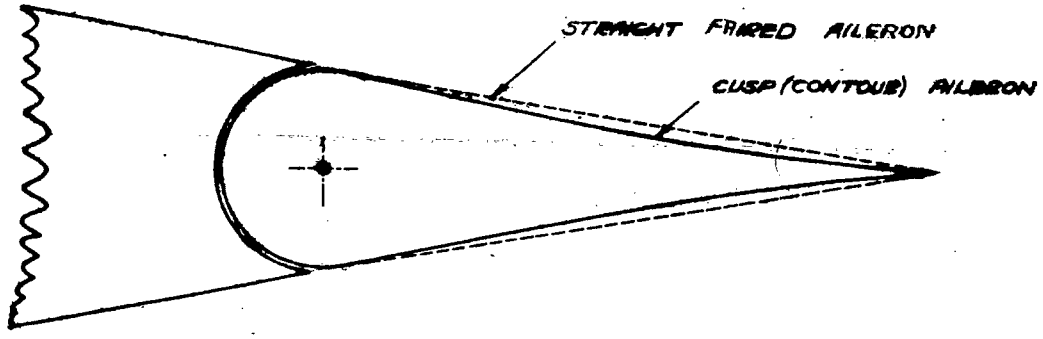

FIGURE 1.— AILERONS SHOWING CUSP AND STRAIGHT FAIRED TYPES.

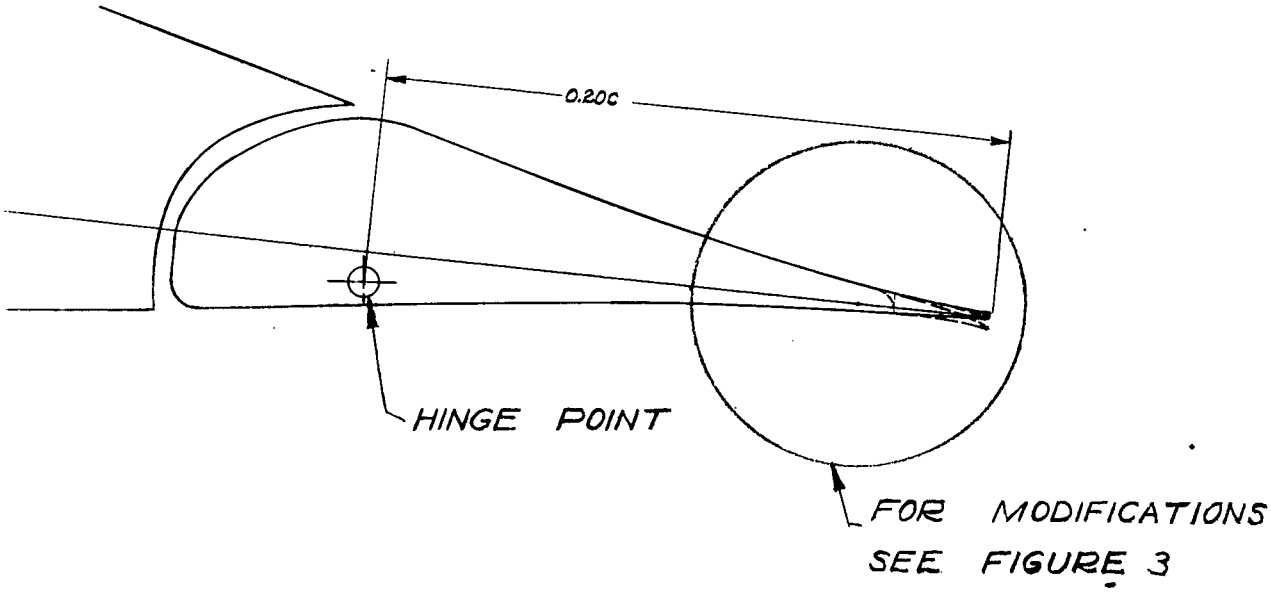

FIGURE 2.—NACA 65,2-417 (APPROX.) TEST MODEL FOR TRAILING-EDGE MODIFICATIONS.

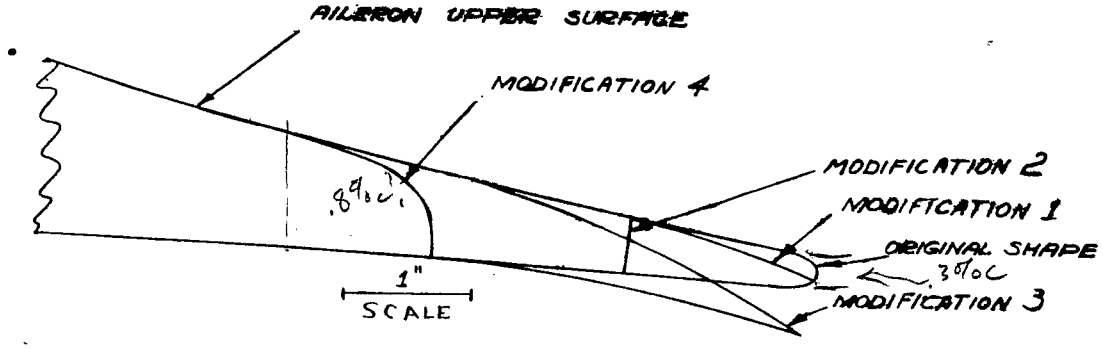

FIGURE 3.— MODIFICATIONS OF TRAILING EDGE OF A 0.20C FRISE-TYPE AILERON ON A 100-INCH CHORD LOW-DRAG MODEL.

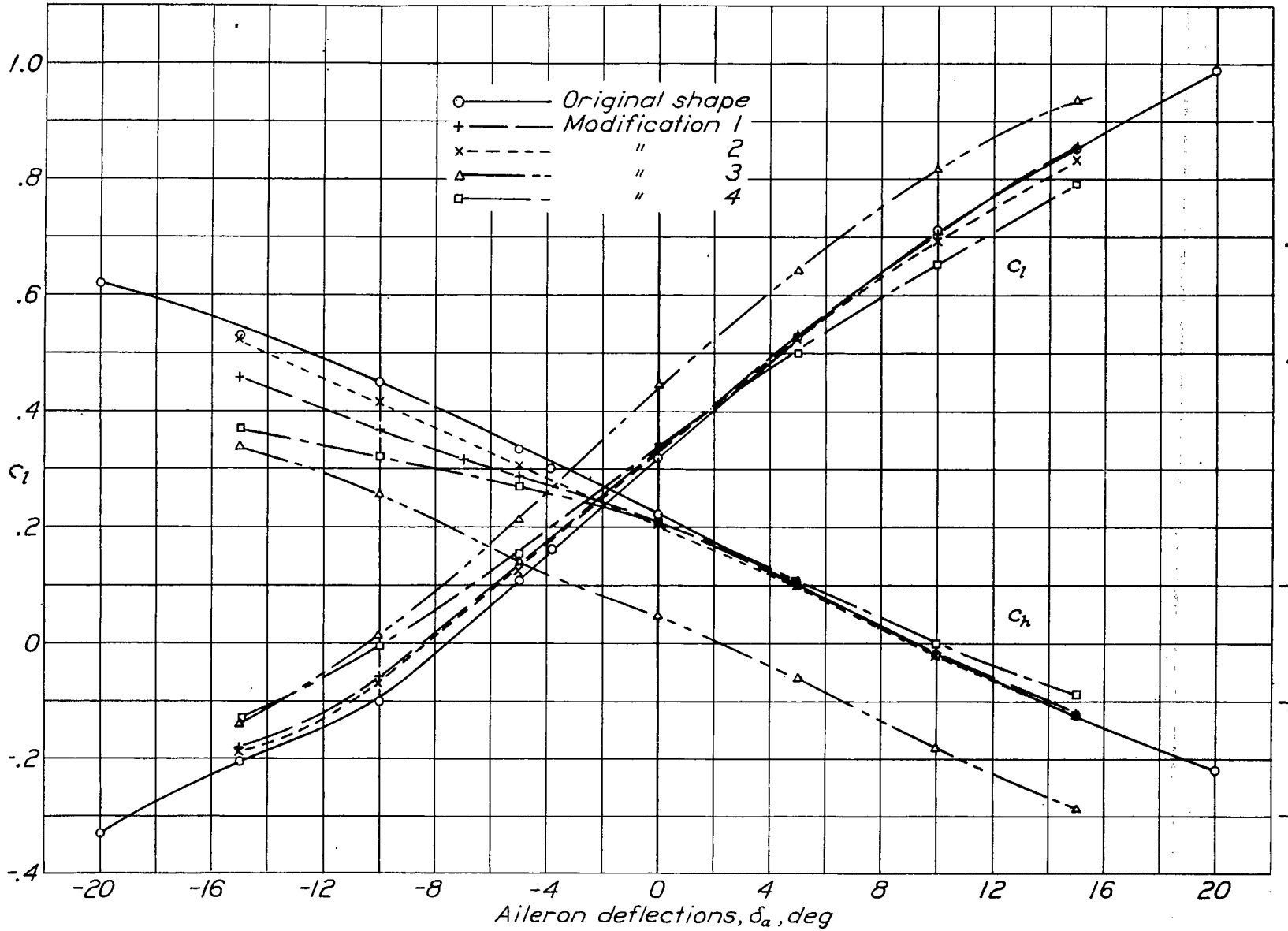

Figure 4.- Aileron effectiveness and hinge moments for modifications of the trailing edge of a 0.20c Frise-type aileron on a 100-inch chord low-drag model. (See figure 2 for modifications.) α, 1.3° ; aileron slot open ; coefficients based on actual area.

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